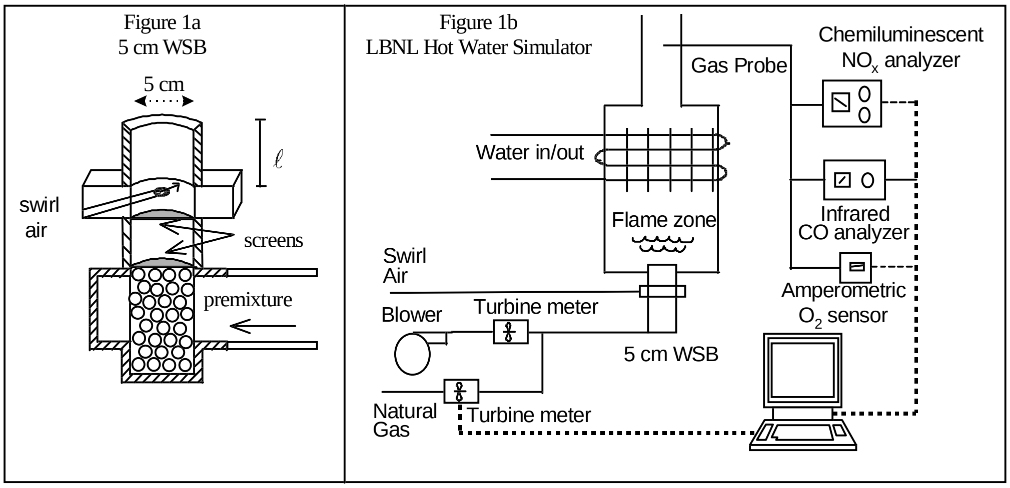

Figure 1: Schematics of the 5 cm WSB used in the LBNL water heater simulator (A_c / A_b = 15).

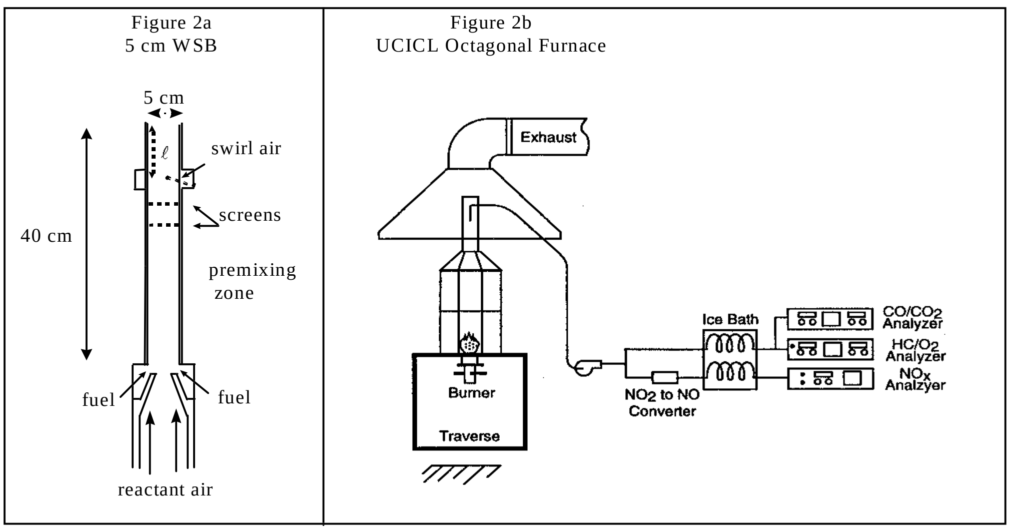

Figure 2: Schematics of the 5 cm WSB used in the UCICL octagonal enclosure (A_c / A_b = 142).

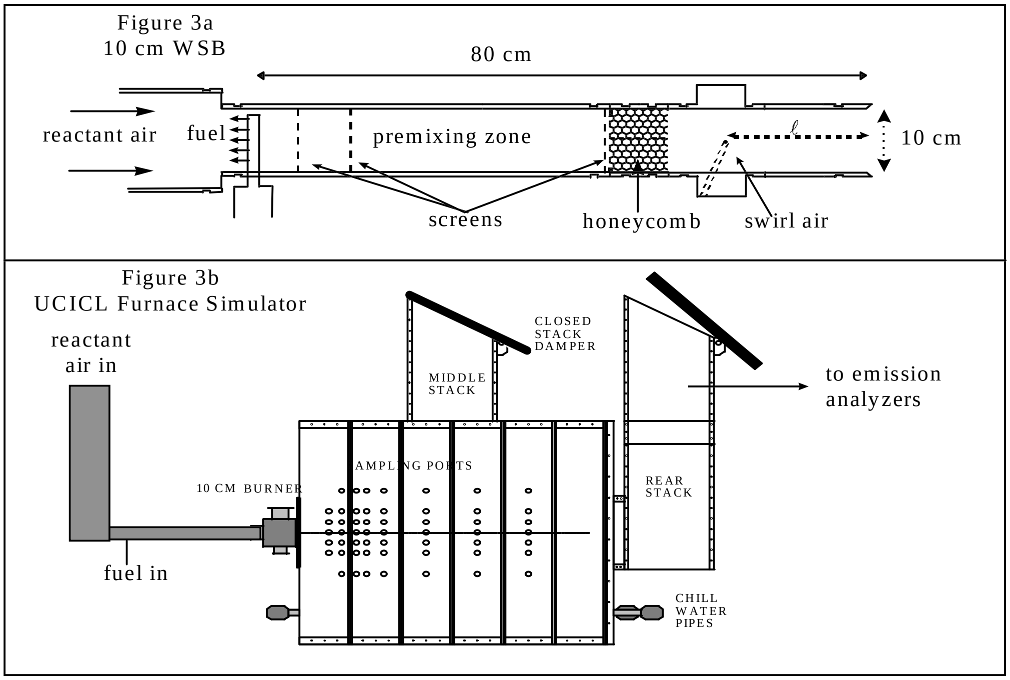

Figure 3: Schematics of the 10 cm WSB in the UCICL furnace simulator (A_c / A_b = 733).

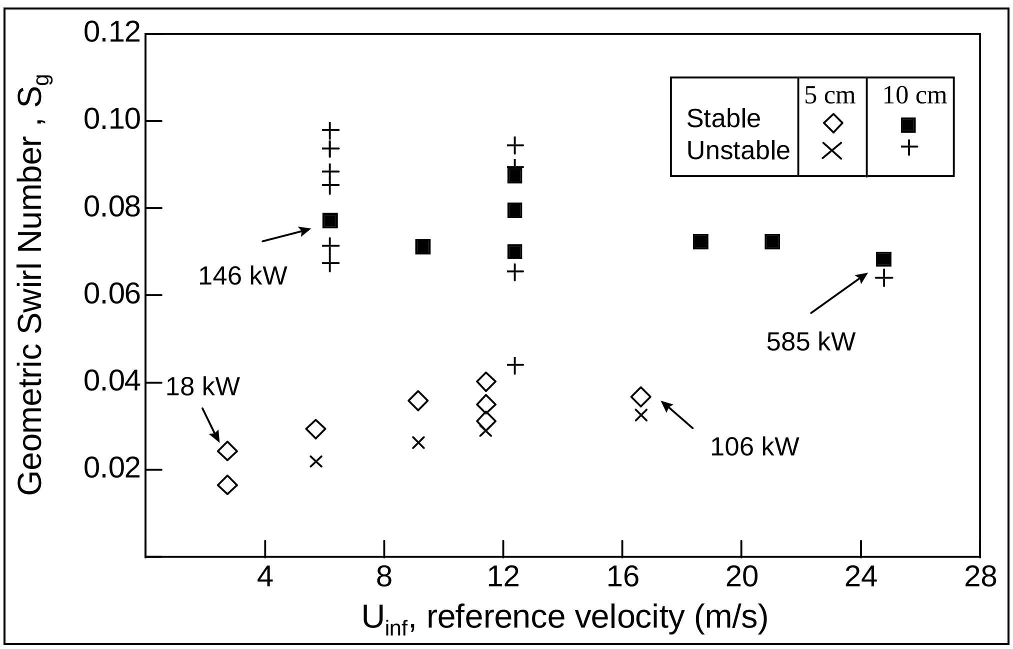

Figure 4: The operating regime of the 5 and 10 cm in the UCICL combustion chambers over similar velocity regimes shows a significant increase in the non-dimensional swirl number S_g (and thus swirl air) needed for stability.

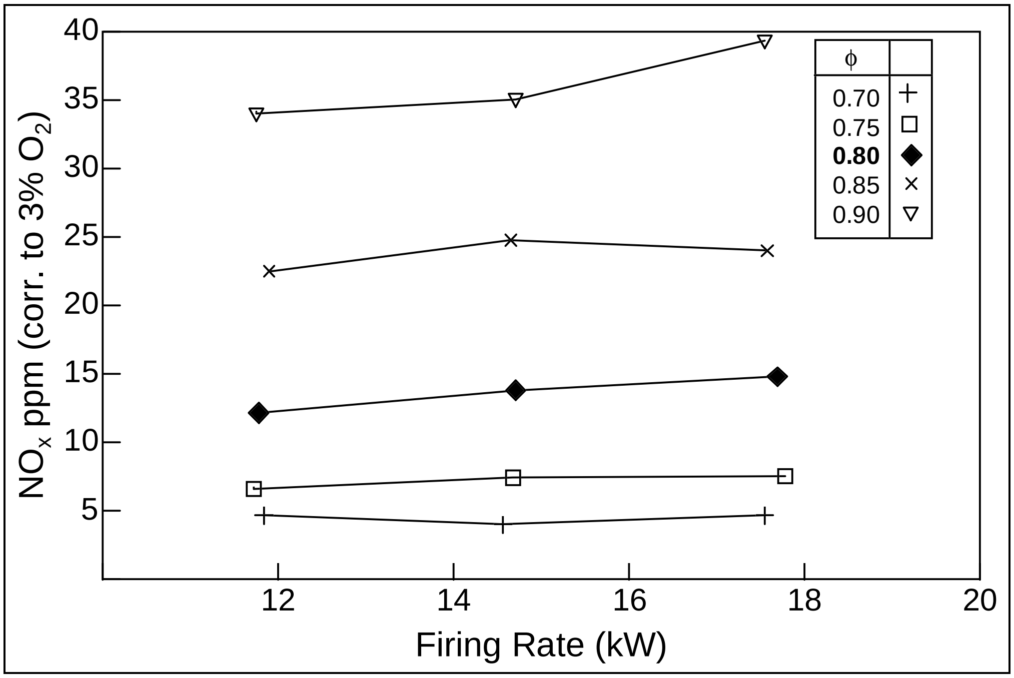

Figure 5: NO_x emissions from the LBNL water heater simulator with the 5 cm WSB (A_c / A_b = 15) displays primary dependence on the equivalence ratio and little dependence on firing rate. For $\phi < 0.90$, the WSB exceeds the strictest regulations of SCAQMD 1146.2

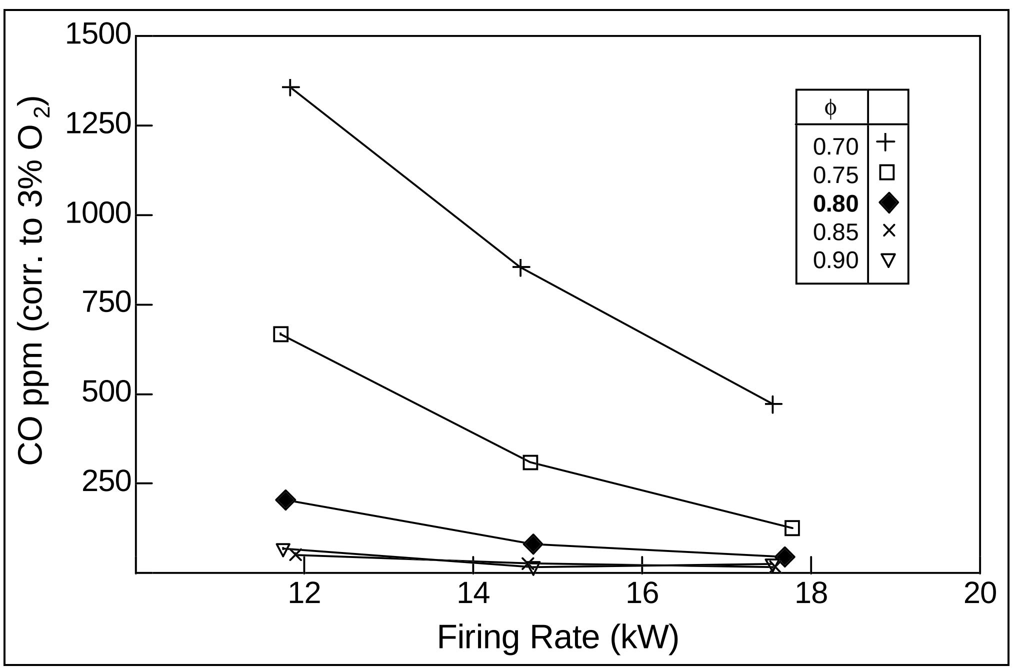

Figure 6: CO emissions from the LBNL water heater simulator with the 5 cm WSB (A_c / A_b = 15) demonstrate dependence on both firing rate and equivalence ratio.

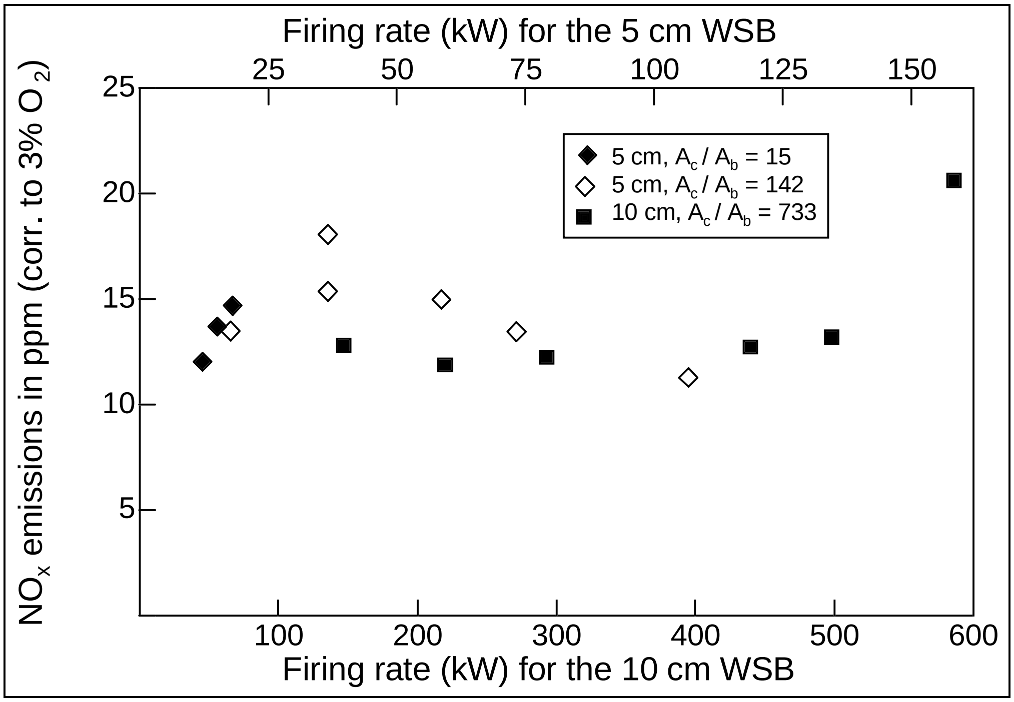

Figure 7: NO_x levels are constant at ≈ 15 ppm for the three chamber/burner ratios and for a firing rates from 12 to 585 kW.

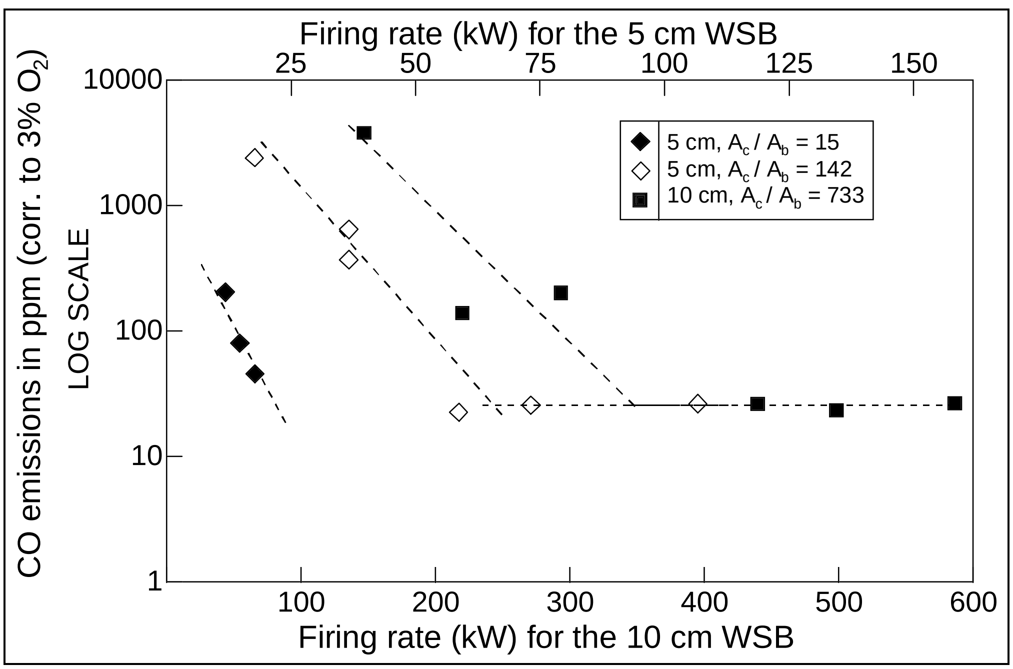

Figure 8: As plotted on a logarithmic scale, CO emissions display a strong dependence on both firing rate and A_c / A_b. Minimum firing rates of ≈ 25, 65, and 400 kW are necessary to achieve CO levels of 25 ppm for A_c / A_b = 15, 142, and 733 respectively. Dashed lines are not fit to the data.

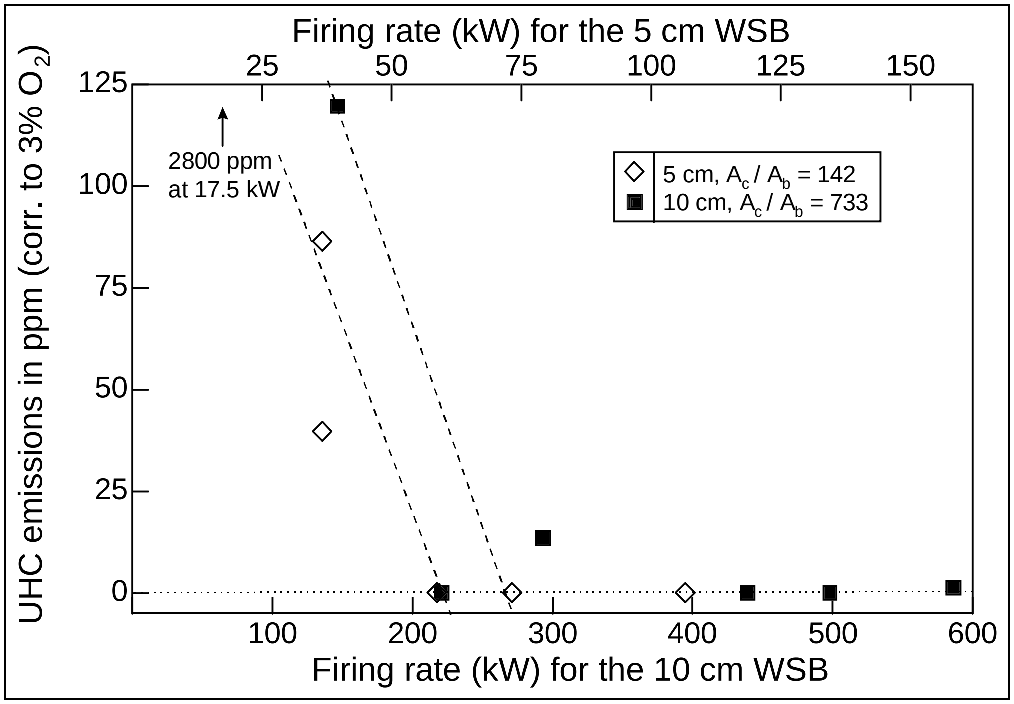

Figure 9: UHC emissions decrease dramatically with increasing firing rate however no conclusion can be drawn on the effect of A_c / A_b on emission levels. Above ≈ 75 and 300 kW (similar U_{ref} of 12 m/s), emissions are essentially 0 ppm.